Kredit und Kapital, 42. Jahrgang, Heft 1, Seiten 1–23
Abhandlungen

Financial Predictors of Real Activity and the Propagation of Aggregate Shocks

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I. Introduction and Literature Review

As economic policy is interested in the information content of financial variables for real activity and inflation, numerous studies have examined which variables have a "useful role in a policy-maker's information set" (*Gertler/Lown* (1999), p. 133). Since empirical evidence for the USA suggests that 'traditional' financial indicators, like short-term interest rates or the term spread, seem to have lost forecasting power for real activity (*Gertler/Lown* (1999), *Mody/Taylor* (2004)),[1] measures drawing on the financial accelerator (premiums for external funds) have attracted considerable attention in this respect. Arguments therefore are as follows.[2] Due to some friction in financial markets or the market for loans, there exists a wedge between the cost of external and the opportunity cost of firm-internal funds, the external finance premium (EFP).[3] This premium therefore is prevalent with bank-based financing (*Bernanke/Gertler/Gilchrist* (1996)) as well as on the market for corporate bonds (*de Bondt* (2004)). As it is argued in the literature on the balance sheet channel of monetary policy transmission, the EFP is endogenous because one of its

[1] The literature review of *Stock/Watson* (2003) reveals that the term spread has more information content for real output growth in non-U.S. OECD countries, whereas *Davis/Fagan* (1997) argue that the forecasting power of the term spread is also limited for European countries. *Crespo Cuaresma/Gnan/Ritzberger-Grünwald* (2005), however, show that adjusting the term spread for time-varying risk premia increases its predictive content for real activity in the euro area. *Davis/Fagan* (1997) also argue that researchers and policy-makers have searched for indicators also to supplement monetary aggregates (their information content has reduced due to financial innovation) and exchange rates (which lost forecasting power due to their increasing volatility). Advantages of asset prices and returns are their swift availability and negligible measurement error (*Stock/Watson* (2003)).

[2] Despite referring to firms here, a similar reasoning may apply for household borrowing.

[3] Among the synonyms for the EFP are 'default spread', 'credit spread' or 'credit quality spread'.

main determinants, the creditworthiness of the (potential) borrowers, is influenced by monetary policy and the business cycle. If interest rates rise or economic activity shrinks, corporate borrowers' net worth and credit ratings deteriorate and default probabilities rise. The balance sheet strength of borrowers, which is procyclical, induces the countercyclicality of the external finance premium that amplifies the fluctuations of economic activity via its effects on borrowers' spending decisions. Additionally, the cost of external financing may also be affected by the ability and the willingness of the banking sector to provide loans. However, the bank lending channel mainly emphasizes the direct effects of monetary policy on the aggregate spending of bank-dependent borrowers if the aggregate supply of credit is not fully decoupled from open market operations (*Kashyap/Stein* (1994)).

Another strand of the literature describes the cyclicality of markups (price-cost margins) as a propagation channel of aggregate shocks. Especially in economies with bank-based financial systems, countercyclical markups in the pricing of loans (e. g. measured by spreads of lending over deposit rates) could contribute to an amplification of macroeconomic fluctuations. Adapting the possible reasons for markup countercyclicality put forward in the literature to the banking sector, such a channel could be operative with loan pricing if also banks act more competitively in periods of high demand. This might be due to collusion being harder to be maintained then (*Rotemberg/Woodford* (1991)), or because of variations in the price elasticity of loan demand (also as a consequence of the changing availability and attractiveness of other forms of corporate finance over the cycle). Thirdly, capital market imperfections also matter in this context (*Chevalier/Scharfstein* (1995)). Switching costs, for example, give banks some market power that allows them to charge borrowers, who were previously locked in through lower loan rates and markups, with higher payments in recessions (*Dueker/Thornton* (1997)).

Empirical work mainly deals with external finance premiums in the bond market and banks' interest rate spreads to examine their predictive content for real activity (the growth rate of GDP, or the output gap as in *Gertler/Lown* (1999)). The yields of low-rated corporate bonds represent the relevant cost of external funds in *Gertler/Lown* (1999), *de Bondt* (2004) and *Mody/Taylor* (2004), the opportunity cost of internal finance is usually a risk-free rate (government bond yield). These studies generally find that their ('high-yield') corporate bond spreads have predictive content for future output growth. *Guha/Hiris* (2002) show that the credit

spread (the term they use for the EFP on bond markets) is significantly higher during recessions than during expansions and that its turning points contain significant information about future turning points of the U.S. business cycle. Complementing the results of *de Bondt* (2004) for the euro area, *Davis/Fagan* (1997) show that the long-term private-public bond spread leads output growth in Denmark and the UK, but not in Germany (these are the three countries for which they had data on the EFP). Interest rate spreads between lending and deposit rates are, for example, applied by *Shan/Morris* (2002). They use data for 19 OECD countries, China and South Korea, and find little evidence for spreads (which are interpreted as indicators of financial development and the efficiency of financial intermediation) leading output growth.

In this paper, various proxies of external finance premiums and banking sector markups are employed to examine whether they and which of them have predictive content for real activity in Austria. These financial measures, which are described in section II., also contain external fincance premiums for intermediated borrowing (which mostly have been neglected in the empirical literature), as well as interest rate spreads relating to consumer and housing credit. By means of impulse response functions from bivariate vector autoregressions (see section III. for the methodological framework used) it is found that, above all, interest rate spreads are significantly leading real output growth in Austria. In this respect, interest rate spreads have superior explanatory power compared to real stock returns, the EU Economic Sentiment Indicator and the OECD Composite Leading Indicator for Austria (except in the very short term). As it will be argued in section IV., this is not sufficient to conclude that financial (and markup) accelerator mechanisms are at work. Results show that interest rate spreads (and other financial measures) lose their leading indicator property in statistical terms in more sophisticated multivariate models. However, this may be due to overfitting (as in *Estrella/Mishkin* (1998)), and it can be observed that the estimates of GDP growth responses for shocks in interest rate spreads are surprisingly robust to the inclusion of additional variables. Further investigation reveals that many of the proposed financial measures do not vary significantly with the business cycle, a precondition for playing a role in the propagation and amplification of aggregate shocks. Interest rate spreads behave even procyclically, which is against a bank-based financial accelerator mechanism in Austria. Section IV. also presents some thoughts and results on the possible influence of financial market integration. It turns out that there may be a certain relevance of the euro area bond market as a shock propagation channel also for Austria.

II. Examined Predictors of Real Activity

The potential leading indicators of Austrian output growth proposed can be classified as follows. First, there are measures of financial conditions prevailing for security-based as well as intermediated financing. The corporate bond spread (the external finance premium in the bond market), defined as the difference between the yields of corporate and government bonds, might not be very informative about a financial accelerator as mainly high-quality borrowers have issued market debt in Austria. However, even in this case it could lead real activity because it contains expectations about future default (*Gertler/Lown* (1999)). Additionally, if financial conditions are correlated across markets, the corporate bond spread could be informative with respect to future growth even if bond financing is small relative to bank finance (*Gertler/Lown* (1999)). The difference between the commercial credit interest rate and the corporate bond yield is referred to as bank finance premium here. *Kashyap/Stein* (1994) suggested this measure to identify potential effects of changes in loan supply on bank finance conditions. Measures derived from retail interest rates, however, have to be carefully interpreted as banks may also vary the non-price terms of bank loans. This concern also applies to interest rate premiums, the spreads of contractual retail rates (on commercial, consumer and housing loans) over the government bond yield. A similar premium was also calculated using ex-post data from the banking-sector balance sheet and its income statement. To obtain this interest income premium, the risk-free rate was deducted from the average interest rate earned on loans to non-banks.

Second, measures of markups in the banking sector contain interest rate spreads, proxies of Lerner indices, and net interest margins (spreads). Interest spreads are calculated as the differentials between the above-mentioned lending rates and the interest rate on savings deposits with an agreed maturity of over twelve months (as correlations of the lending rates are highest for this deposit rate). The Lerner indices used are only proxies for the difference between price and marginal cost (weighted by price) and, as in *Gischer/Jüttner* (2003), apply solely to banks' interest business. Total interest income divided by total assets replaces the price of bank production and marginal cost is approximated by the average interest cost per unit, interest expenses divided by total assets.[4] Conse-

[4] *Gischer/Jüttner* (2003) argue that replacing marginal by average (ex-post) interest rate costs works well if interest rates, across the board, adjust swiftly to key interest rate changes.

quently, these Lerner indices can be calculated by dividing net interest income by interest revenues, which is done for the total net interest income and the net interest income from business with non-banks only. The net interest margin (net interest income of the banking sector relative to its total assets) and the net interest spread from the non-bank business (the average lending rate less the average deposit rate in the interest business with non-banks, derived from balance sheet and income statement data) complete the list of bank markups.[5]

A third group contains other potential predictors of real activity. The term spread is calculated as the difference between the yield of government bonds and the overnight money market rate. Additionally, we apply the real returns on the ATX share price index, the EU Economic Sentiment Indicator and the growth rate of the OECD CLI (Composite Leading Indicator, trend restored).

Real activity is measured by the growth rate of real GDP (quarterly level), relative to GDP in the same quarter of the previous year. Descriptive statistics as well as information about data availability can be found in Table 1, the data sources are quoted in the appendix. Measures derived by means of data from the income statement of the Austrian banking sector are so small because quarterly levels (of flow variables) were used to calculate these variables.

III. Methodological Framework

Unrestricted vector autoregressions (VAR), with their orders chosen by use of the Schwarz information criterion, form the basis of the empirical investigation. The predictive content of the proposed (financial) measures for output growth is evaluated by means of generalized impulse responses

[5] There are no references to and results reported for the following measures: interest rate premiums for retail rates on hypothecary and municipal loans, the interest income premium based on the average interest rate on interest-earning assets of the banking sector (total interest income divided by the level of interest-earning assets), the net interest margin on interest-earning assets only, and the net interest spread calculated from total interest-earning assets and interest-bearing liabilities. The reason for ignoring them in this article is that, for example, the results for the more general interest rate premium are similar to those obtained for the measure specific to the non-bank business. A similar argument applies to the remaining neglected measures. Even other variables, like the spreads of lending rates over bank bond yields, are disregarded because these variables are neither practically nor statistically significant indicators of future growth in Austria.

Table 1

Descriptive Statistics and Length of Time Series

Variable	N	Availability	Mean	Std.Dev.	Minimum	Maximum
Corporate bond spread	53	93:1–06:1	0.46	0.50	–0.13	2.29
Bank finance premium	34	95:1–03:2	1.25	0.53	0.12	2.27
Commercial credit premium	34	95:1–03:2	1.72	0.43	0.80	2.41
Consumer credit premium	34	95:1–03:2	2.80	0.54	1.75	3.59
Housing credit premium	34	95:1–03:2	1.32	0.45	0.34	2.04
Interest income premium (non-banks)	69	89:1–06:1	0.95	0.51	0.05	2.04
Commercial credit spread	34	95:1–03:2	3.37	0.31	2.92	4.02
Consumer credit spread	34	95:1–03:2	4.45	0.48	3.85	5.57
Housing credit spread	34	95:1–03:2	2.96	0.26	2.57	3.53
Lerner Index (total NII)	77	87:1–06:1	27.02	4.20	18.87	36.00
Lerner Index (non-bank NII)	69	89:1–06:1	55.41	4.50	44.94	62.40
Net interest margin	77	87:1–06:1	0.37	0.07	0.24	0.49
Net interest spread (non-banks)	69	89:1–06:1	0.73	0.15	0.47	0.94
Term spread	68	89:2–06:1	0.69	1.02	–1.53	2.41
Real stock returns	77	87:1–06:1	0.08	13.53	–43.31	35.46
Economic Sentiment	42	95:4–06:1	100.39	10.02	75.87	118.90
Leading indicator growth	77	87:1–06:1	1.08	1.33	–2.35	4.32
GDP growth	77	87:1–06:1	2.28	1.35	–0.65	4.65

This table contains descriptive statistics and information about data availability for the following time series: the corporate bond spread (the spread of the corporate bond yield over the government bond yield), the bank finance premium (the gap between the interest rate on short-term loans to enterprises and the corporate bond yield), the commercial, consumer and housing credit premiums (the government bond yield deducted from the interest rate on either short-term loans to enterprises, loans to households for consumption purposes, or loans to households used for purchasing housing space), the interest income premium (the average banking sector's ex-post lending rate to non-bank customers less the government bond yield), the commercial, consumer and housing credit spreads (the spreads of the respective lending rate over the interest rate on savings deposits with an agreed maturity of over 12 months), Lerner indices for the entire interest business of the banking sector (net interest income, NII, divided by total interest revenues) and for the non-banks interest business only (net interest income from the interest business with non-banks divided by interest revenues from loans to non-banks), the banking sector's net interest margin (net interest income as a share of total assets), the net interest spread from the non-bank business (the average ex-post interest rate charged on loans to non-banks less the average ex-post rate paid for deposits from non-banks), the term spread (the overnight money market rate deducted from the government bond yield), real stock returns (of the ATX share price index), the EU Economic Sentiment Indicator for Austria, and the growth rate of the OECD Composite Leading Indicator (trend restored) for Austria.

(GIR) and variance decompositions (GVD), as proposed by *Koop/Pesaran/Potter* (1996) and *Pesaran/Shin* (1998). Generalized impulse response functions are said to describe how a typical historical innovation affects the dynamics of the model. Compared to responses and variance decompositions obtained from shocks orthogonalized by Choleski decomposition, the GIR and GVD do not depend on the variable ordering.[6] The innovations are scaled to represent unit shocks (the means and standard deviations in Table 1 give a hint on how large or, respectively, typical such a unit shock is for each variable). Corresponding error bands were simulated via Monte Carlo Integration with 2000 draws. To assess statistical significance, we approximate 95 % confidence intervals by means of the 0.025 and 0.975 fractiles of the response distribution. GIR are reported for the quarter the shock occurs and quarters 1, 2, 4 and 8 thereafter, the reported GVD are the ones prevailing two years after the shock.

Additionally, an assessment of the indicators' forecast performance is carried out, based on different sets of forecasts obtained from rolling regression (following the approach of *Gertler/Lown* (1999)). Predictions from a univariate (rolling) autoregression of GDP growth with one lag serve as the benchmark, the second set of forecasts comes from a growth equation with one lag of the respective indicator variable in addition to lagged growth. Because of the reduced-form nature of the second forecasting model, a third one (which is labeled the 'structural' model) is utilized which also includes the contemporaneous indicator variable in the forecasting equation. Besides one-step forecasts, a one-year prediction is obtained when using GDP growth led three periods as the dependent variable in all three forecasting equations. Relative forecasting performance is evaluated by calculating ratios of the root mean squared error (RMSE) from the univariate autoregression and the other forecasts. Consequently, values greater than unity indicate that the RMSE from the reduced-form or the structural model's forecasts, respectively, is smaller than the benchmark RMSE. In this case, the model containing the indicator variable has a more satisfactory forecasting performance (see *Davis/Fagan* (1997)). The predictive accuracy test of *Diebold/Mariano* (1995) is applied to test whether the differences in the squared forecast errors are zero.

[6] The impulse response function (IRF) for variable y_i due to a shock in variable y_j describes the deviations of the response variable from its no-shock path over time. Forecast error variance decomposition (FEVD) splits the mean squared forecasting error of variable $y_{i,t+s}$ into the contributions of the individual endogenous variables' innovations.

IV. Results

1. Impulse Responses, Variance Decompositions and Forecast Performance

The first part of the empirical strategy to assess the predictive content of financial variables for output growth in Austria is to evaluate impulse responses from bivariate vector autoregressions. The VAR order chosen by means of the Schwarz information criterion is one throughout. From Table 2 it can be inferred that impulses in the corporate bond spread, the bank finance premium, as well as in the term spread, have no information content for future output growth in Austria (that would imply statistically significant responses at the 5 % level). Shocks in premiums for intermediated credit, apart from the one in consumer credit rates, entail one statistically significant response of GDP growth. However, some of the bank markup measures, the commercial and the housing credit spread, perform best in terms of the forecast error in real activity they determine, as well as in terms of statistical and, in all probability, practical significance. Changes in the EU Economic Sentiment Indicator and the growth rate of the Composite Leading Indicator (similar to real stock returns) precede the business cycle, although with different time horizons.[7]

Table 3 reports the results from the assessment of the out-of-sample prediction performance. As the latter varies across sample periods, the period for which all indicator variables are available is evaluated at first. Due to the small sample, forecasts are generated for the last eight observations only. The table contains the root mean squared errors from the benchmark relative to those obtained for the 'structural' model, and the associated results from the test of whether the differences in the squared forecast errors are zero. It turns out that all interest spreads improve longer-term forecasts, whereas adding the sentiment or the leading indicator to a univariate growth equation significantly reduces forecast errors for one-quarter predictions. Considering the net interest spread leads to relatively better forecasts for both horizons, at least for the time period considered.[8]

[7] Leading growth by one period, to account for the informational lag in GDP data, does not importantly change the results. The response estimates, more or less, shift one period back in time.

[8] If, for each indicator, all available data is used to generate forecasts, the RMSE ratios for the net interest margin and spread, the Lerner indices, as well as for the corporate bond spread and the bank finance premium, are all slightly

Table 2

Responses of GDP Growth (Bivariate VAR)

After quarter	0	1	2	4	8	GVD
Corporate bond spread	–0.218	–0.308	–0.257	–0.127	–0.023	1.42
Bank finance premium	–0.516	–0.668	–0.624	–0.412	–0.134	19.69
Commercial credit premium	–0.726	–0.974*	–0.973	–0.713	–0.242	24.09
Consumer credit premium	–0.591	–0.850	–0.878	–0.683	–0.271	23.64
Housing credit premium	–0.794	–0.960*	–0.925	–0.665	–0.234	24.21
Interest income premium (non-banks)	–0.697	–0.554	–0.440	–0.276	–0.108	0.40
Commercial credit spread	1.201	–1.574	–3.067	–3.465*	–0.951	30.36
Consumer credit spread	0.677	–0.756	–1.464	–1.714	–0.898	18.90
Housing credit spread	–0.483	–3.184*	–4.240*	–3.678*	–0.716	43.94
Lerner Index (total NII)	–0.142	–0.078	–0.039	–0.004	0.007	3.86
Lerner Index (non-bank NII)	–0.071	–0.027	–0.005	0.010	0.007	1.18
Net interest margin	–9.648*	–8.059	–6.212	–3.308	–0.802	7.37
Net interest spread (non-banks)	–2.737	–5.544	–6.164	–5.032	–2.136	10.46
Term spread	0.449	0.224	0.101	–0.001	–0.031	3.67
Real stock returns	0.008	0.026*	0.017*	0.005*	0.001	11.31
Economic Sentiment	0.063*	0.045*	0.032	0.018	0.010	14.24
Leading indicator growth	0.082	0.247*	0.287*	0.206*	0.029	13.65

This table presents within-quarter and selected subsequent generalized responses of the growth rate of real GDP to one-unit impulses in the respective indicators. Bivariate vector autoregressions with a lag order of one form the basis of the response calculations, with sample periods depending on data availability. The reported error bands were obtained via Monte Carlo Integration with 2000 draws, and 95 % confidence intervals were approximated by means of the 0.025 and 0.975 fractiles of the response distribution. Asterisks indicate statistical significance at the 5 % level. GVD is the percentage of the mean squared forecasting error in GDP growth after eight quarters due to innovations in the particular indicator variable.

Next, results are reported for what *Gertler*/*Lown* (1999) call 'horse races' of two predictors against each other (and undertake for the high-yield spread against oil prices, the term spread and other indicators of the monetary policy stance). Corresponding results can be found in

above one, and differences in the squared forecast errors with respect to the univariate prediction are not statistically significant at the 5 % level. Surprisingly, this is also the case for economic sentiment and leading indicator growth, whereas considering real stock returns improves GDP growth forecasts significantly in case the forecast models are estimated over the full sample periods.

Table 3

Relative Out-of-Sample Forecast Performance

	Relative RMSE	
Indicator variable	1 quarter	1 year
Corporate bond spread	0.98	1.07
Bank finance premium	1.08	1.03
Commercial credit premium	1.08	0.98
Consumer credit premium	1.18	0.96
Housing credit premium	1.24	1.00
Interest income premium (non-banks)	1.13	1.12
Commercial credit spread	0.96	1.39*
Consumer credit spread	0.93	1.27*
Housing credit spread	0.93	1.34*
Lerner Index (total NII)	0.90	0.87
Lerner Index (non-bank NII)	0.96	0.89
Net interest margin	1.18	1.23
Net interest spread (non-banks)	1.30*	1.37*
Term spread	0.85	0.98
Real stock returns	0.94	0.99
Economic Sentiment	1.66*	1.07
Leading indicator growth	1.40*	1.04

For the purpose of assessing the indicators' out-of-sample forecasting performance, the sample period is the same for all evaluated models and therefore restricted to 1995:1–2003:2. Forecasts from a univariate autoregression of GDP growth (with one lag) are compared to forecasts from a model including the respective contemporaneous indicator and one lag of it in addition to past GDP growth. One-quarter as well as one-year (with growth led three periods as the dependent variable) predictions are obtained for the last eight quarters of the sample period via rolling regressions. For both forecasting horizons, the root mean squared error (RMSE) of the benchmark set of predictions from the univariate model is divided by the RMSE of the forecasts obtained via the model including the indicator variable. A relative RMSE value greater than unity therefore indicates that considering the respective indicator reduces the average squared forecasting error. The predictive accuracy test of *Diebold/Mariano* (1995) is used to examine whether the squared errors from two sets of forecasts are significantly different. Asterisks indicate statistically significant differences at the 5% level, against a one-sided alternative hypothesis.

Table 4, which reports generalized impulse responses and variance decomposition from trivariate VAR models including ouput growth and two predictors at a time. Three indicators related to the financial accelerator theory were selected for this exercise, the commercial and the housing credit rate spread over the savings interest rate and, as representing a

Table 4

Responses of GDP Growth (Trivariate VAR)

After quarter	0	1	2	4	8	GVD
Commercial credit spread	1.201	–1.576	–3.067	–3.462*	–0.950	29.34
Real stock returns	0.011	0.011	0.008	0.004	–0.001	3.23
Commercial credit spread	1.513	–1.234	–2.532	–2.822	–1.231	24.17
Economic sentiment	0.032	0.029	0.025	0.018	0.008	9.05
Commercial credit spread	0.724	–1.039	–2.851	–3.968*	–0.797	31.49
Leading indicator growth	0.039	0.258	0.234	0.022	–0.092	8.94
Housing credit spread	–0.386	–3.105	–4.177*	–3.816*	–1.056	41.70
Real stock returns	0.010	0.008	0.001	–0.004	–0.003	1.89
Housing credit spread	–0.230	–2.805	–3.613*	–2.962*	–0.960	32.53
Economic Sentiment	0.034	0.032	0.029	0.022	0.010	11.23
Housing credit spread	–0.494	–2.694	–3.995*	–3.809*	–0.522	38.90
Leading indicator growth	0.034	0.277	0.310	0.159	–0.036	14.01
Interest income premium (non-banks)	–0.599	–0.593	–0.431	–0.207	–0.048	6.05
Real stock returns	0.010	0.022*	0.017*	0.008	0.002	11.14
Interest income premium (non-banks)	–0.706	–0.499	–0.357	–0.188	–0.056	6.15
Economic Sentiment	0.063*	0.045	0.032	0.017	0.005	13.44
Interest income premium (non-banks)	–0.424	–0.647	–0.493	0.118	0.421	7.81
Leading indicator growth	0.292*	0.423*	0.411*	0.196	–0.100	22.94

This table presents within-quarter and selected subsequent generalized responses of the growth rate of real GDP to one-unit impulses in the respective indicators. Each table fragment is based on a trivariate vector autoregression with a lag order of one, involving GDP growth and two competing indicator variables. The reported error bands were obtained via Monte Carlo Integration with 2000 draws, and 95 % confidence intervals were approximated by means of the 0.025 and 0.975 fractiles of the response distribution. Asterisks indicate statistical significance at the 5 % level. GVD is the percentage of the mean squared forecasting error in GDP growth after eight quarters due to innovations in the particular indicator variable.

premium in bank finance comparable with other measures for a longer time period, the interest income premium for the non-bank business. The pairwise comparisons in the different panels of Table 4 show that, in general, the interest rate spreads outperform stock returns, the sentiment and the composite indicator, whereas the responses of real activity to shocks in the interest income premium lose their statistical significance in this setting.[9]

[9] The commercial interest premium (results not reported), exemplary for the ex-ante finance premiums in intermediated credit, 'beats' the Economic Sentiment, but not the Composite Leading Indicator.

Now that we have seen that certain financial measures negatively lead real GDP growth, how might this finding relate to financial factors being at work in shaping the business cycle? It certainly is 'compatible with' or 'in line with' the predictions of the financial accelerator theory, as it is cautiously worded by *Gertler/Lown* (1999) or *Mody/Taylor* (2004). At least two objections would be raised against any bolder statement.

First, as *Davis/Fagan* (1997, p. 705) note, conclusions from an assessment of forecasting power are "only valid with respect to the information set included in the analysis". As a bivariate analysis can only examine whether the financial predictors have forecasting power beyond that of lagged economic activity, this first objection points to a richer model on two grounds. On the one hand, it is, at least hypothetically, possible that a 'third variable' drives both the financial measure and GDP growth. Even if this is not the case, the inclusion of other variables (to reduce the bias from omitted variables in the reduced-form VAR) may let the marginal predictive content of financial indicators disappear. On the other hand, a multivariate model is also warranted with regard to the interpretation of the shocks. Determinants of financial spreads and premiums that do not directly relate to the financial accelerator should therefore be endogenized. Table 5 reports estimation results from various enlarged systems evaluating the predictive content of the two credit spreads from the previous exercise. The significance level is increased to 10 % accounting for that, endorsed by the small sample sizes, indicators may lose much of their predictive power when an even parsimonious model is enlarged (as argued by *Estrella/Mishkin* (1998)).[10] When sticking to the 5 % level, one could not observe any statistically significant responses in Table 5.

From its first panel it can be seen that the inclusion of the inflation rate, above all, induces changes in the predictive content of the housing credit spread. When the OECD indicator and the real effective exchange rate (REER) are added to the VAR model, no statistically significant effects remain at the 10 % level. An interesting result, however, is that the magnitudes of the GDP growth responses to impulses in the interest spreads are quite robust for the fourth post-shock quarter.

Still richer models contain two additional sets of variables. Set A contains some factors that the literature (*Gischer/Jüttner* (2003), *Maudos/*

[10] From this perspective, it is more understandable that *Shan/Morris* (2002) find only little evidence for interest spreads leading output growth. Among the 'control variables' included in their VAR models are the interest rate level, stock prices and the inflation rate.

Table 5

Responses of GDP Growth in Multivariate VAR

After quarter	0	1	2	4	8	GVD
VAR includes the inflation rate						
Commercial credit spread	1.790	–0.377	–1.892	–2.954*	–1.129	17.85
Housing credit spread	0.241	–2.030	–2.824*	–2.278	0.044	13.68
VAR additionally includes the REER and leading indicator growth						
Commercial credit spread	2.631	1.226	–1.013	–3.399	–1.463	22.09
Housing credit spread	0.295	–1.540	–2.563	–2.473	–0.396	15.40
VAR additionally includes banking-sector variables (set A)						
Commercial credit spread	3.503	2.292	–0.665	–3.817	–1.081	19.20
Housing credit spread	1.646	–0.316	–2.263	–3.326	–0.580	12.38
VAR additionally includes banking-sector variables (set B instead of set A)						
Commercial credit spread	2.223	0.705	–0.147	–2.579	–1.551	12.89
Housing credit spread	0.012	–0.870	–1.004	–3.100	–0.784	14.51

This table presents within-quarter and selected subsequent generalized responses of the growth rate of real GDP to one-unit impulses in the respective indicators. Each table fragment is based on multivariate vector autoregressions with a lag order of one, involving GDP growth, either the commercial or the housing credit spread and the additionally quoted variables. These comprise the inflation rate (the percentage growth rate of the consumer price index relative to the previous year), the real effective exchange rate of the Austrian Schilling and the euro, respectively, and the growth rate of the OECD Composite Leading Indicator for Austria. Set A contains the following variables (in percent) for the Austrian banking sector: concentration (the share of the top 10 banks in total assets), openness (measured as foreign assets plus foreign liabilites of the banking sector divided by its total assets), the cost-income ratio (operating expenses divided by operating income) and the share of non-interest income (in total operating income). Set B contains the percent shares of loans to non-banks, secured debt and equity capital in the balance sheet of the banking sector. The reported error bands were obtained via Monte Carlo Integration with 2000 draws, and 95 % confidence intervals were approximated by means of the 0.025 and 0.975 fractiles of the response distribution. Asterisks indicate statistical significance at the 5 % level. GVD is the percentage of the mean squared forecasting error in GDP growth after eight quarters due to innovations in the particular indicator variable.

Fernández de Guevara (2004))[11] proposes as determinants of interest rate margins and spreads. The concentration in as well as the cost-income ratio of the banking sector are included. The other two measures should also account for changes in financial spreads due to structural developments as financial liberalization (proxied by banking sector openness) and the reduced importance of interest income (measured by the share of non-interest income in the total operating income of the banking sector). Resulting changes in the responses of real activity are rather minor. The

[11] For the determinants of corporate bond spreads, see e. g. *de Bondt* (2004) and the references therein.

alternatively used set B includes interest spread determinants that are related to the bank lending channel, the shares of loans, secured debt and equity capital in the balance sheet total of the banking sector. Magnitudes of some of the responses are now reduced still more, but especially the effects on GDP growth after four quarters are still very large, indicating that there is room left for a financial accelerator mechanism at work. However, none of the responses is statistically significant at the 10% level, and if they were, the evidence for an operative balance sheet channel would still be incomplete.[12]

The second objective to hastily concluding that financial accelerator mechanisms are causing interest (yield) spreads and premiums to predict growth is related to the direction of 'causality'. To conclude that such a mechanism is operative, it has to be verified that the relevant financial measures themselves vary with the interest rate level or the business cycle. The leading indicator property then describes the macroeconomic relevance of the balance sheet channel (*de Bondt* (2004)). *Gertler/Lown* (1999) refer to the negative correlation of the high-yield spread with a measure of corporate balance sheet strength in this respect. A related issue is that a negative lead of financial variables for activity is compatible with an accelerator as well as with a dampening effect. As *Braumann* (2004) argues, Austrian interest rate spreads between lending and deposit rates (contrary to those in Canada, Sweden and the USA) rise with credit growth, which can be interpreted as pointing to a financial de-celerator in Austria.

The responses of the financial measures to unit shocks in GDP growth are reported in Table 6. Four of these variables seem to vary significantly (in statistical terms, at the 5% level) with the business cycle, with one of them being the interest income premium. Its limited forecasting power, however, was already demonstrated above. With respect to the commercial credit spread it is found that it rises during an upswing. A

[12] In these described settings, the inflation rate is the best-performing predictor of real activity (it negatively leads) in terms of the statistical significance of GDP growth responses and as measured by variance decompositions. The openness of the banking sector, the cost-income ratio and the share of equity capital in the balance sheet of the banking sector emerge as the relatively more important determinants of the interest rate spreads (increases in all three variables precede reductions in credit spreads). As regards the size of the responses of real activity to shocks in the interest rate spreads, it is tempting to believe that responses from orthogonalized shocks in the context of a structural VAR might differ significantly from the generalized ones presented here. From an agnostic shock identification scheme (Choleski decomposition, interest rate spreads and GDP growth ordered last), however, it can be inferred that these differences are rather small.

Table 6

Responses of Financial Measures to Shocks in GDP Growth (Bivariate VAR)

After quarter	0	1	2	4	8	GVD
Corporate bond spread	–0.019	–0.051	–0.047	–0.024	–0.004	6.72
Bank finance premium	–0.148	–0.128	–0.103	–0.061	–0.019	12.84
Commercial credit premium	–0.108	–0.067	–0.041	–0.014	–0.001	6.66
Consumer credit premium	–0.101	–0.078	–0.060	–0.034	–0.011	6.93
Housing credit premium	–0.127	–0.088	–0.061	–0.030	–0.007	9.80
Interest income premium (non-banks)	–0.094*	–0.097*	–0.092	–0.072	–0.035	12.18
Commercial credit spread	0.015	0.039	0.048*	0.042*	0.007	24.54
Consumer credit spread	0.017	0.025	0.027	0.023	0.010	5.68
Housing credit spread	–0.008	0.015	0.026	0.015	0.006	8.13
Lerner Index (total NII)	–0.330	–0.790*	–0.953*	–0.873*	–0.415*	39.67
Lerner Index (non-bank NII)	–0.218	–0.343	–0.361	–0.277	–0.099	8.49
Net interest margin	–0.005	–0.008*	–0.008*	–0.005*	–0.001	21.92
Net interest spread (non-banks)	–0.003	–0.005	–0.006	–0.004	–0.002	5.89

This table presents within-quarter and selected subsequent generalized responses of the quoted variables to a one-unit impulse in the growth rate of real GDP. Bivariate vector autoregressions with a lag order of one form the basis of the response calculations, with sample periods depending on data availability. The reported error bands were obtained via Monte Carlo Integration with 2000 draws, and 95% confidence intervals were approximated by means of the 0.025 and 0.975 fractiles of the response distribution. Asterisks indicate statistical significance at the 5% level. GVD is the percentage of the mean squared forecasting error in the particular response variable after eight quarters due to innovations in GDP growth.

fall in the Lerner index is hard to interpret as it may shrink also for trivial reasons. Everything else equal – especially volumes and the structure of banks' balance sheets, even a rise in the (average) interest rate spread may cause the Lerner index to decrease, for example, if the percentage rate of increase for the lending rate is smaller than that of the deposit rate. Impulses in the Lerner indices do not significantly lead output growth anyway, as we have seen. However the countercyclicality of the net interest margin comes about (from assets or liabilities, volumes or interest rates, new business or outstanding amounts, non-interest-bearing assets, etc.), the corresponding responses are practically small. So, in the end, there is no stringent evidence to be found from this exercise in favor of a financial accelerator being at work in Austria, neither through the bond market nor through the banking sector. On the other hand, the increases of the interest rate spreads due to shocks in GDP growth are too small as well to be seen as part of a bank-based stabilization mechanism.

2. *The Role of Financial Market Integration*

As the markets for both government and corporate bonds across the euro area have become highly integrated,[13] it seems possible that euro-zone developments also determine the path of the indicators containing yields on Austrian bonds to a large extent. Given the evidence on a financial accelerator mechanism in the euro area (*de Bondt* (2004)), the result that the corporate bond spread, for example, is no leading indicator of economic activity in Austria may be due to bond yields being synchronized with euro area yields, in combination with country-specific business cycle fluctuations. In this section, evidence shall be gathered concerning the validity of these propositions. The approach pursued is to add selected financial variables for the euro area to the set of potential leading indicators of Austrian GDP growth. It will be examined how they relate to the measures already applied, and the assessment of their leading indicator properties for economic activity in Austria is accompanied by a valuation of the significance of these indicators for the financing of Austrian firms and households. Thereupon, it might be necessary to alter or attenuate the previous statements about the existence and significance of a financial accelerator.

Table 7 presents information on the euro area indicators, which comprise the corporate bond spread, commercial and consumer credit spreads, the term spread and real stock returns (see the appendix for a description and data sources).[14] Despite of the close connection of Austrian to euro area bond yields, it turns out that the respective corporate bond spreads are not correlated at all – the corresponding correlation coefficient is -0.04. Commercial credit spreads for Austria and the euro area do not evolve synchronuously over time as well.[15] Consequently, it does not appear that some of the Austrian indicators proposed exhibit only weak explanatory power for GDP growth because they are mainly driven by external developments on integrated markets. National particularities seem to play a strong role with retail interest rate spreads (and, in all probability, also with the other measures related to bank

[13] See, for example, *Baele/Ferrando/Hördahl/Krylova/Monnet* (2004).

[14] Lending rate premiums were not considered because the time series on the euro area retail rates and the yield of long-term government bonds only overlap for two and a half years.

[15] Commercial and consumer credit spreads for the euro area and Austria even are negatively correlated for the subperiod beginning in 1999 (the correlation coefficient is –0.60 for the commercial and –0.77 for the consumer credit spreads).

Table 7

Descriptive Statistics and Length of Euro Area Time Series

Variable	N	Availability	Mean	Std.Dev.	Minimum	Maximum
Corporate bond spread	29	99:1–06:1	0.22	0.48	–0.91	1.22
Commercial credit spread	31	96:1–03:3	3.52	0.37	3.08	4.24
Consumer credit spread	31	96:1–03:3	6.85	0.26	6.20	7.30
Term spread	49	94:1–06:1	1.73	0.77	0.15	3.36
Real stock returns	61	91:1–06:1	–0.42	9.70	–30.75	21.06
GDP growth	57	92:1–06:1	1.77	1.27	–1.80	4.60

This table contains descriptive statistics and information about data availability for the following euro area time series: the corporate bond spread (the spread of the corporate bond yield over the yield of long-term government bonds), the commercial and the consumer credit spread (the interest rate on savings deposits with an agreed maturity of up to two years deducted from the interest rate on short-term loans to enterprises and on consumer loans, respectively), the term spread (the government bond yield less the overnight money market), and real stock returns (calculated by means of the Datastream Global Index for the euro area, deflated by the euro area consumer price index).

finance), which is in line with the evidence on credit market integration.[16]

Results on whether the euro area indicators are leading the Austrian growth rate of real GDP can be found in Table 8. It becomes evident that the euro area corporate bond spread does, which might have two reasons. On the one hand, it may be a result of the corporate bond spread predicting European economic activity combined with a high degree of business cycle synchronization between Austria and the euro area.[17] On the other hand, it might be the case that a financial accelerator is operative in Austria via the financing conditions on external bond markets. The minor relevance of bonds in Austrian corporate finance, however, keeps the macroeconomic significance of such a mechanism within a limit, even if the euro area corporate bond spread is (to a certain extent) representa-

[16] For example, *Baele* et al. (2004) report that credit markets in the euro area (especially with short-term loans to enterprises and with consumer credit) are still segmented and that cross-border retail banking activities are limited. The diversity in retail interest rates across the euro area is also reported and discussed in *Fernández de Guevara/Maudos/Pérez* (2007) and several publications of the European Central Bank.

[17] Evidence in favor of the former proposition is reported by *de Bondt* (2004), the latter one is supported by a correlation between euro area and Austrian growth rates of real GDP of 0.67 for the whole sample and 0.76 for the post-1998 period. The fact that euro area stock returns also lead Austrian growth takes the same line.

Table 8

Responses of Austrian GDP Growth to Shocks in Euro Area Indicators (Bivariate VAR)

After quarter	0	1	2	4	8	GVD
Corporate bond spread	–0.852	–1.261*	–1.270*	–0.820*	–0.083	37.45
Commercial credit spread	–2.184	–2.538	–2.685*	–2.774*	–2.653	33.36
Consumer credit spread	–1.157	0.230	1.153	1.766	0.579	12.93
Term spread	0.073	0.359	0.448	0.361	0.081	10.02
Real stock returns	0.022	0.035*	0.018*	0.007*	0.001	11.92

This table presents within-quarter and selected subsequent generalized responses of the Austrian growth rate of real GDP to one-unit impulses in the respective indicators for the euro area. Bivariate vector autoregressions with a lag order of one form the basis of the response calculations, with sample periods depending on data availability. The reported error bands were obtained via Monte Carlo Integration with 2000 draws, and 95 % confidence intervals were approximated by means of the 0.025 and 0.975 fractiles of the response distribution. Asterisks indicate statistical significance at the 5 % level. GVD is the percentage of the mean squared forecasting error in GDP growth after eight quarters due to innovations in the particular indicator variable.

tive for the costs of bond issuances that do not take place via the Vienna Stock Exchange.[18] A similar conclusion can be drawn with respect to euro area credit markets, but because of the fact that loans in Austria still are mainly taken out with domestic banks. The commercial credit spread for the euro area leads Austrian growth over the full sample period, but does not if only the period from 1999 on is evaluated (a period with a very high negative correlation between the respective spreads for the euro area and Austria). As its Austrian counterpart, the consumer credit spread for the euro area has no predictive content, which is also the case for the term spread.

Further insight on the effects of financial market integration on the previously presented results can be gained from evaluating changes in the indicators' predictive content over time. As between 1994 and 1998 the effects from Austria's joining of the European Economic Area interfere with the anticipation of Stage III of the European Monetary Union (EMU), only the euro years make up a subperiod that can be sensibly evaluated. Also for this space of time, the Austrian corporate bond

[18] *Waschiczek* (2005) argues that international investment banks and investors play a strongly increasing role with the subscription and issuance of Austrian corporate bonds. The share of the volume of corporate bonds listed at the Vienna stock exchange in total corporate debt in form of securities (excluding shares and investment share certificates) with an agreed maturity of more than one year was about 42 % at the end of 2006.

spread has no predictive content for domestic growth. For some indicators (for the commercial and the housing credit premium, the housing credit spread, the interest income premium, and the net interest margin), the statistical significance of the GDP growth rate's responses vanishes. However, results for the commercial credit spread are almost unchanged, and the net interest spread (in the banking sector's non-bank business) becomes a significant predictor of economic activity. Another striking difference to the full-sample results is that the term spreads for Austria and the euro area both lead the Austrian growth rate of real GDP positively. Additionally, the practical significance (the magnitude of the growth responses) of real stock returns, the sentiment and the OECD leading indicator for Austria increases. Although growth reacts to shocks in fewer of them, some Austrian financial variables (especially those related to bank finance) remain helpful leading indicators in times of progressive financial market integration.

Results on the existence of a financial accelerator mechanism (on how the proposed indicators vary with the business cycle) are affected by considering the shorter sample in the following way. All the responses of credit premiums and spreads to growth shocks are now positive, and those of the consumer credit spread additionally become statistically significant. The interest income premium does not significantly fluctuate over the business cycle anymore, and the changes in the net interest spread (though displaying improved predictive power for growth) after a shock in GDP growth now are truly zero. Thus, for the post-1998 subperiod, the evidence collected in this way is increasingly against a financial accelerator.

V. Concluding Remarks

This study has examined the forecasting power of several financial measures with respect to the Austrian growth rate of real GDP. In this respect, retail interest rate spreads perform best and are therefore suited to enrich the information set of economists and policy-makers. The second aim pursued has been to examine the potential role of external finance premiums and interest rate spreads for business cycle amplification. The analysis of several indicators based on Austrian bond yields and retail interest rates of domestic banks does not deliver evidence for financial accelerator mechanisms and countercyclical markups in the banking sector representing significant channels for the propagation of

aggregate shocks in Austria. It cannot, however, be entirely ruled out that the fluctuations of the euro area corporate bond spread are of some relevance for Austria in this respect.

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Appendix: Data Description

Austrian time series. The source of the data is the Austrian Central Bank (OeNB), except for the following series. Real GDP and the real effective exchange rate (1999 = 100) come from the Austrian Institute of Economic Research (WIFO). From 1999 on, the overnight money market rate (for the calculation of the term spread) is the EONIA published by the European Central Bank (ECB). Bond yields are volume-weighted averages of the yields of fixed-interest bonds with more than a year to maturity (corporate bonds are bonds issued by private non-financial enterprises) and the source of the series is the Oesterreichische Kontrollbank (OeKB). The consumer price indices to be chained for calculating the inflation rate (relative to the same quarter of the previous year) come from the Statistik Austria. To calculate real stock returns, the ATX share price index of the Wiener Boerse (Vienna Stock Exchange) was used. The Economic Sentiment Indicator (the data source is the European Commission) is a composite indicator based on consumer and business surveys. Its dimension is balance of opinions in percent. Component series of the OECD Leading Indicator for Austria (trend restored) are opinions from consumer and business surveys, the IFO business climate index for Germany, unfilled job vacancies and the term spread of interest rates.

Retail interest rates come from the national interest rate statistics and were, in this form, compiled from 1995 until June 2003 (from January 2003 on, the national statistics were replaced by a harmonized system for the euro area). Rates are nominal (plus certain fees, but commissions on turnover are not included), expressed as annual percentages and contain the commercial credit rate (on floating-rate loans to enterprises, usually short-term), the consumer credit rate (on secured consumer loans – but not necessarily secured by mortgage, which are usually long-term), the housing credit rate (on all floating-rate, long-term loans to households used for purchasing housing space which are not mortgage loans), the hypothecary credit rate (on floating-rate, long-term mortgage loans to households and enterprises – secured by a mortgage recorded in the land register), the municipal credit rate (on loans to public-sector authorities, usually long-term) and the interest rate on savings deposits with an agreed maturity of over twelve months. Business coverage: Banks report the interest rate charged most frequently for new business (renewals are not considered). Institutional coverage: Sample of 43 Monetary Financial Institutions (had decreased to 37 banks in 2003 because of mergers). As *Klein*/*Schubert*/*Swoboda* (2003) argue, this sample of banks consisted of the major joint stock banks, the state mortgage banks as well as the largest institutions of the

savings bank, Raiffeisen credit cooperative and Volksbank credit cooperative sectors. Aggregation method: Arithmetic averages excluding 5 % of the rates at both ends of the range.

Data on profit and loss account items for the banking sector comes from quarterly bank reports, balance sheet data from monthly balance sheet reports (almost all banks operating in Austria report on the legal basis of the Austrian Banking Act). Balance sheet items are quarterly averages of monthly (of three end-of-month) figures and, as the items from the income statement, in millions of euros.

Real activity is measured by the percentage growth rate of real (quarterly level) GDP relative to real GDP four quarters ago. The money market rate is the overnight VIBOR (Vienna Interbank Offered Rate) and the EONIA, respectively. The remaining time series (which are also measured as percentages) are the openness of the banking sector (foreign assets plus foreign liabilities of the banking sector divided by total assets), the concentration ratio in the banking sector (the share of the 10 largest banks' assets in the balance sheet total of the banking sector), the share of non-interest income in total operating income of the banking sector, the cost-income ratio for the Austrian banking sector (operating expenses divided by operating income), and the respective shares of loans, secured debt and equity capital in the balance sheet total of the banking sector.

Euro area time series. GDP growth is the percentage change in real GDP relative to the same quarter in the previous year, the source of the series is Eurostat. Also the percent yield of long-term government bonds is from Eurostat. The corporate bond yield was extracted from the Datastream database of Thomson Financial (Datastream mnemonic EURCRPB). To calculate the term spread, the euro area overnight interbank rate (source: IMF International Financial Statistics) was deducted from the euro area government bond yield. Euro area interest rates on lending to enterprises (up to one year) and on consumer lending come from Datastream (with the ECB given as the ultimate source). The same is true for deposit rates. The interest rate on deposits with an agreed maturity of up to two years was used to calculated the commercial and consumer credit spreads, as it is the most correlated with the lending rates. The share price index used is the Datastream Global Index for the euro area (mnemonic TOTMKEM). Real stock returns are calculated as the percentage change in the share price index less the euro area inflation rate (the quarterly average of the percentage change in the euro area consumer price index relative to the previous year, source: Eurostat).

Summary

Financial Predictors of Real Activity and the Propagation of Aggregate Shocks

Bond yield and retail interest rate spreads are presumed to lead real activity on the basis of financial accelerator mechanisms, markup cyclicality or simply because they are forward-looking. Empirical results for Austria show that retail interest rate spreads outperform many other indicators in this respect. Nevertheless, there is no evidence for a financial accelerator being behind this finding. The euro area corporate bond market may, however, represent a shock propagation channel of certain relevance for the Austrian economy. Keywords: Leading indicator, business cycle, shock propagation, financial accelerator, bank markup. (JEL E32, E44, G12, G21)

Zusammenfassung

Finanzwirtschaftliche Konjunkturindikatoren und ihre Rolle in der Ausbreitung gesamtwirtschaftlicher Fluktuationen

Die Bedeutung von Prämien auf Anleihenmärkten sowie von Zinsspannen der Banken als vorauseilende Konjunkturindikatoren resultiert aus Theorien zu Finanzakzeleratormechanismen und der Zyklik von Aufschlagssätzen sowie aus der Annahme, dass es sich bei diesen Größen um in die Zukunft gerichtete Indikatoren handelt. Eine Untersuchung für österreichische Daten zeigt, dass Zinsspannen bzw. Zinsmargen in dieser Hinsicht bessere Eigenschaften aufweisen als viele andere Indikatoren. Dennoch lässt sich anhand der Resultate nicht argumentieren, dass ein Finanzakzelerator für diesen Konjunkturvorlauf verantwortlich ist. Es kann aber nicht gänzlich ausgeschlossen werden, dass auch für Österreich die Bedingungen für Anleihenfinanzierung im Euroraum einen Kanal für konjunkturverstärkende Effekte darstellen.